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Vehicle-mounted storage apparatus equipped with a safety lock device

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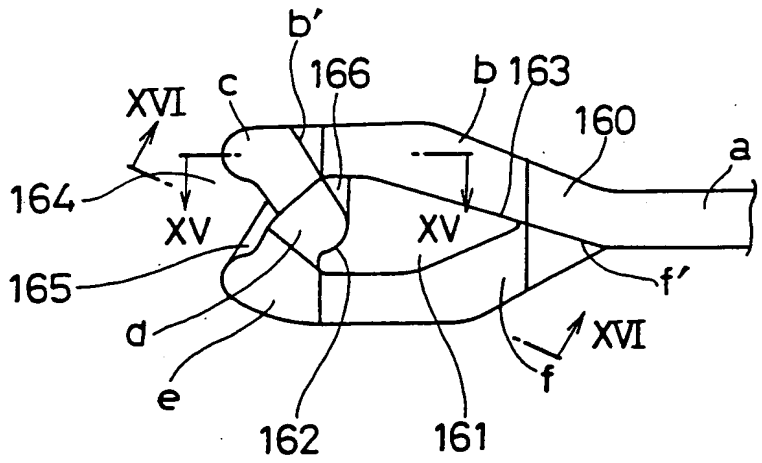
第 1 図



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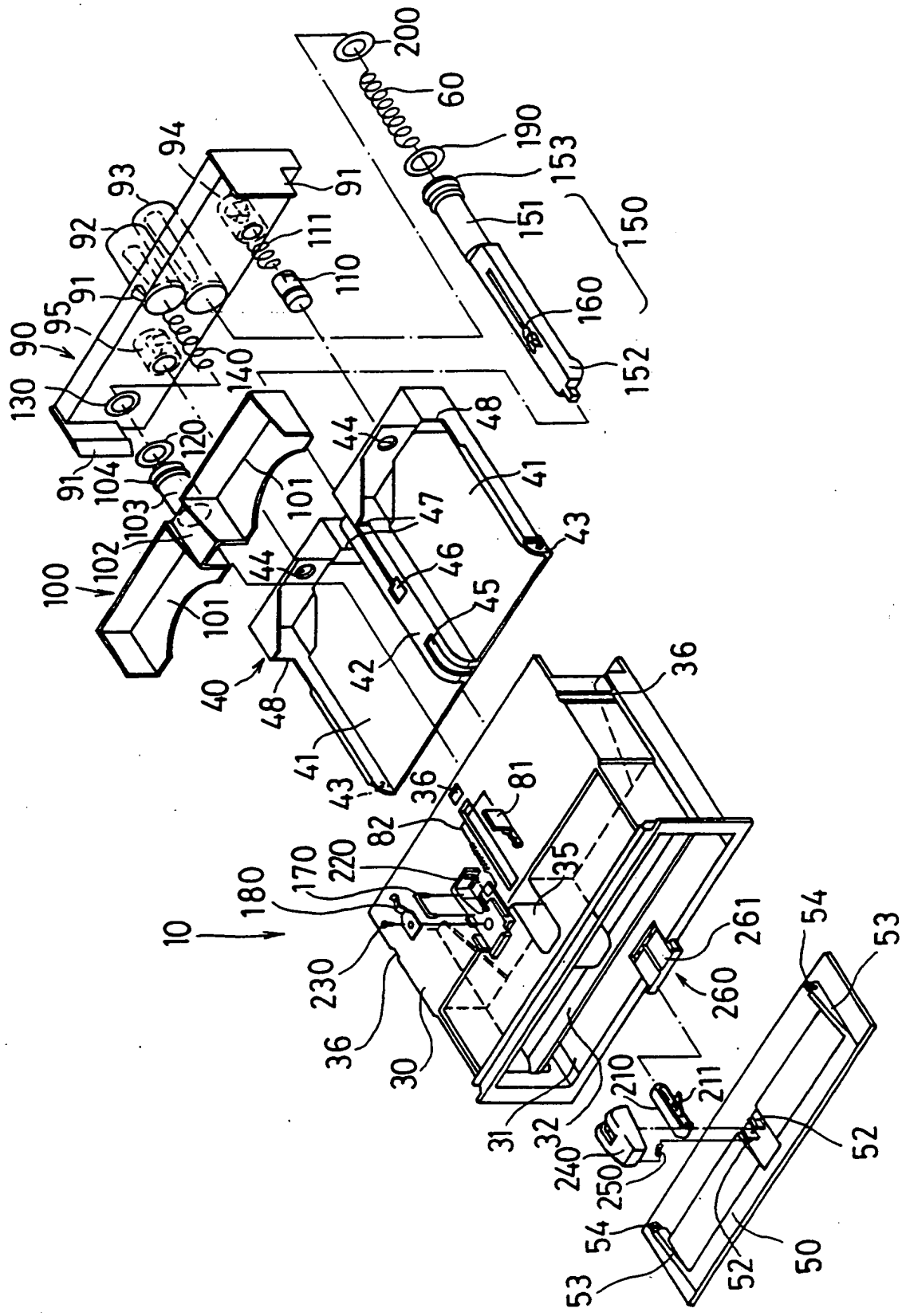
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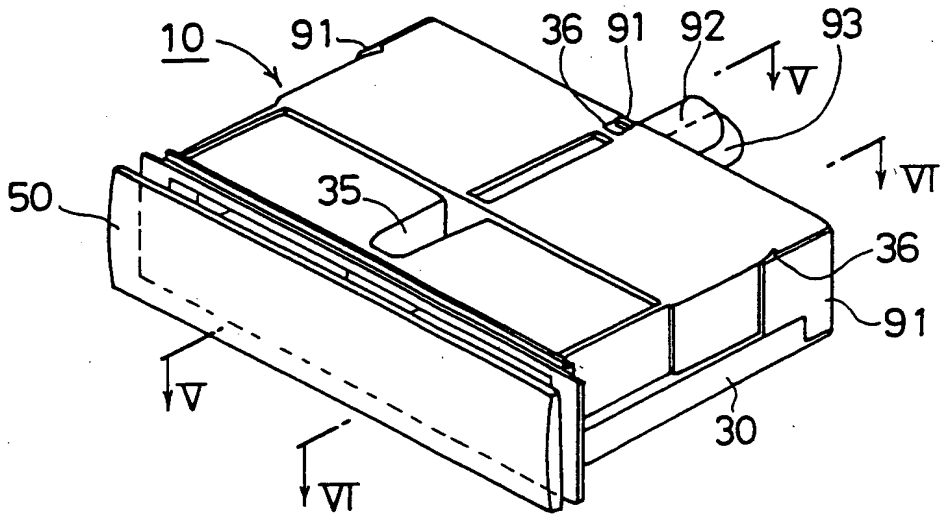

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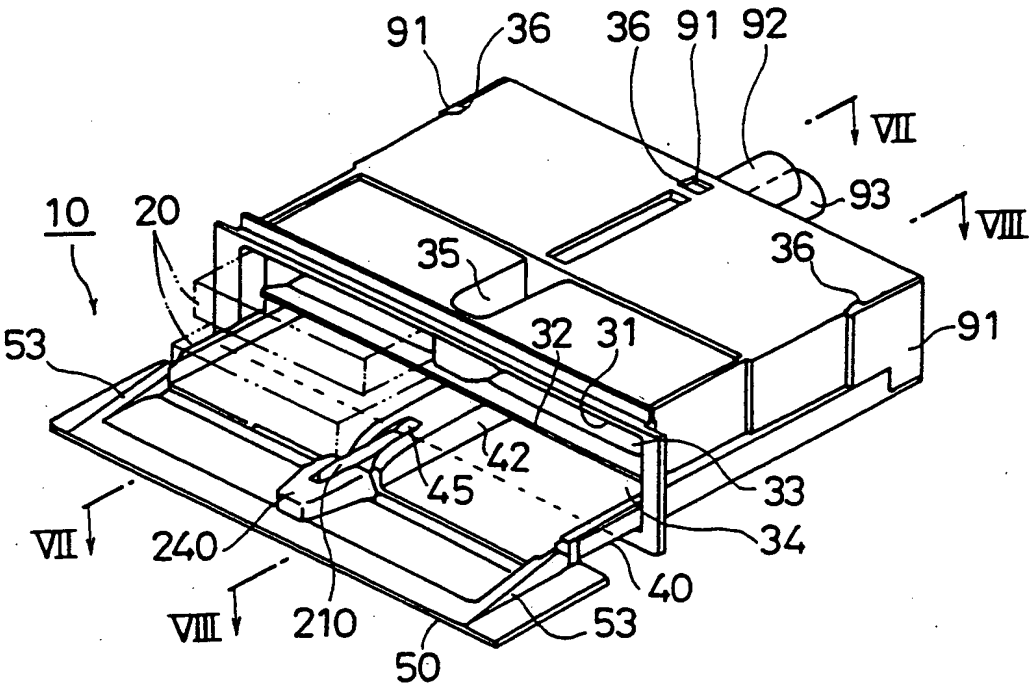
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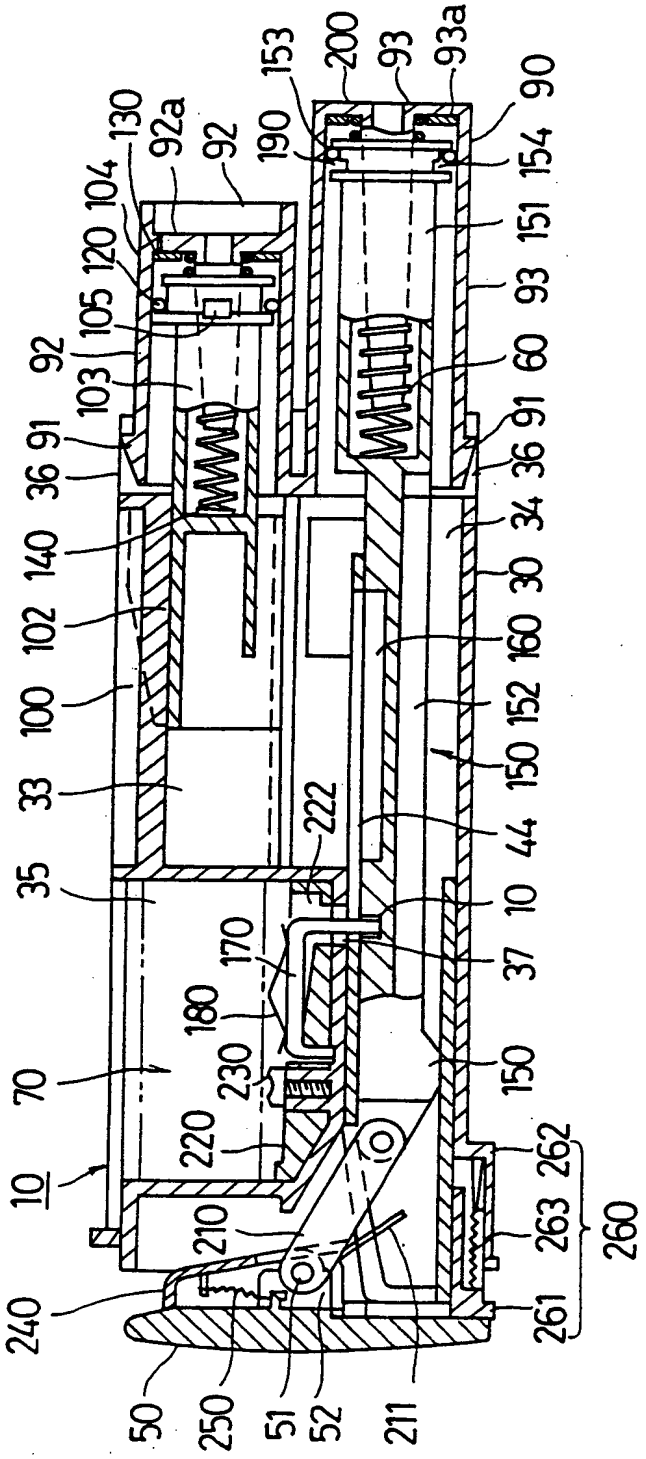
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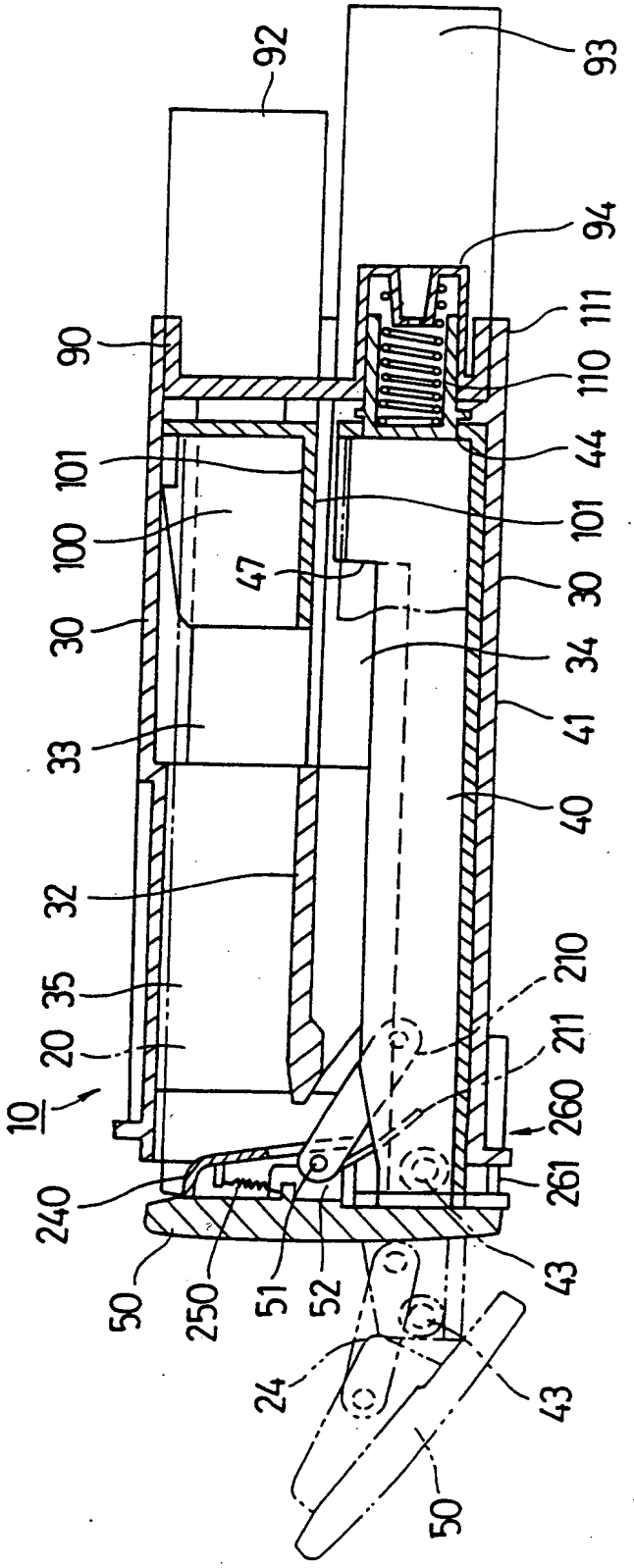
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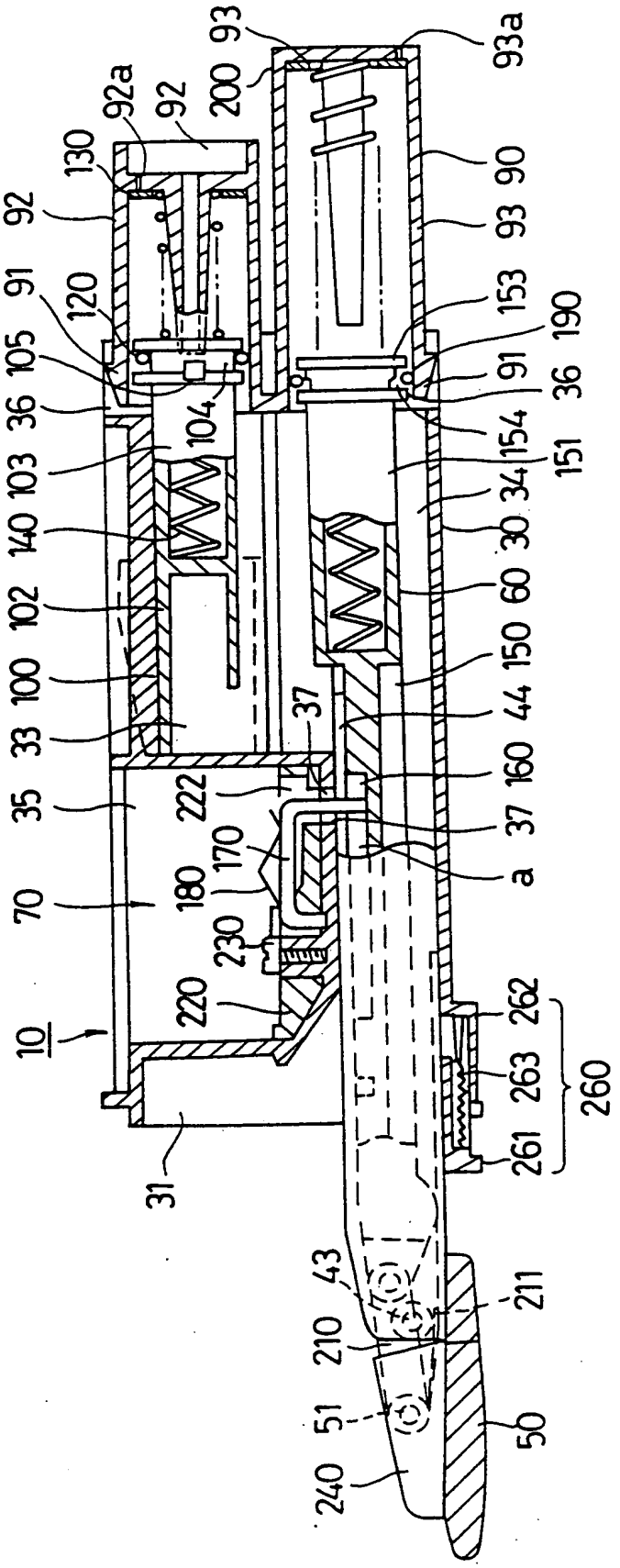
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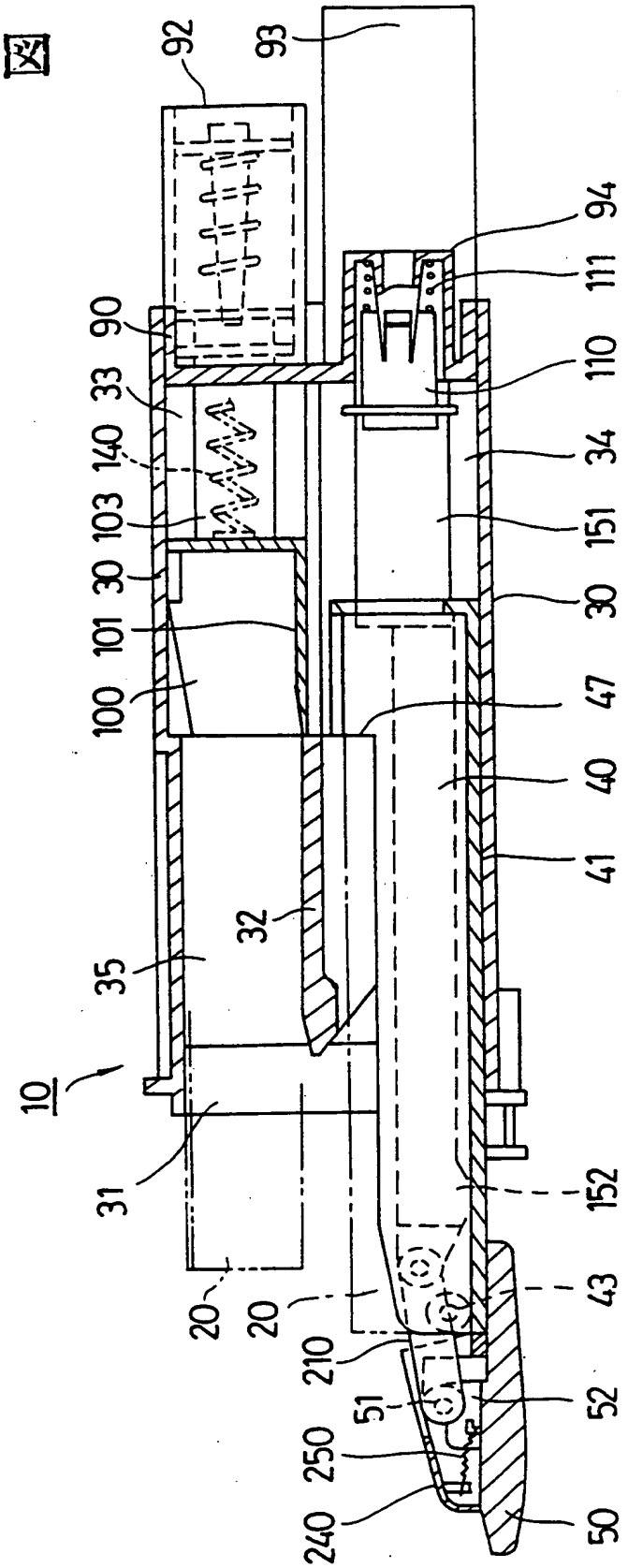
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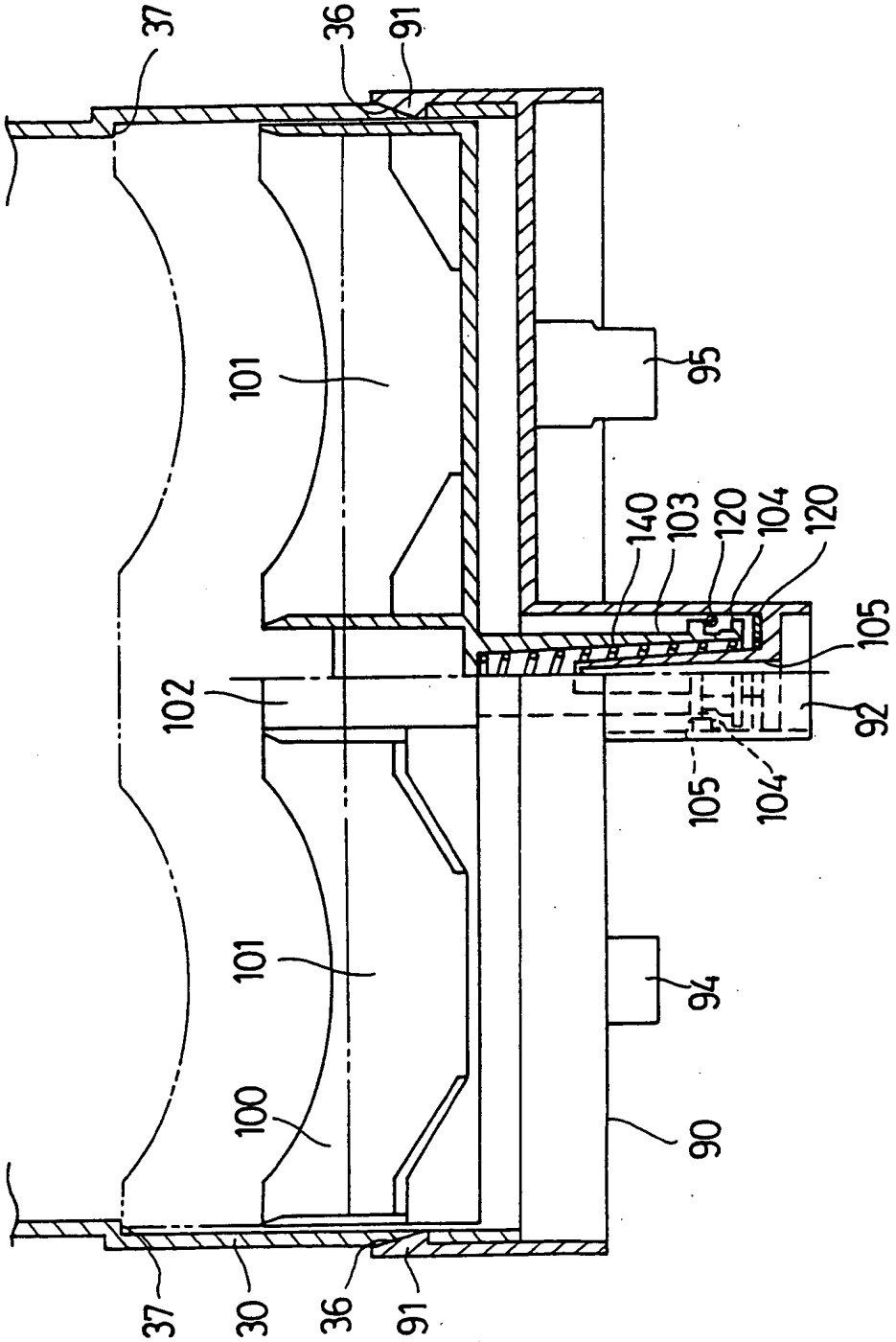
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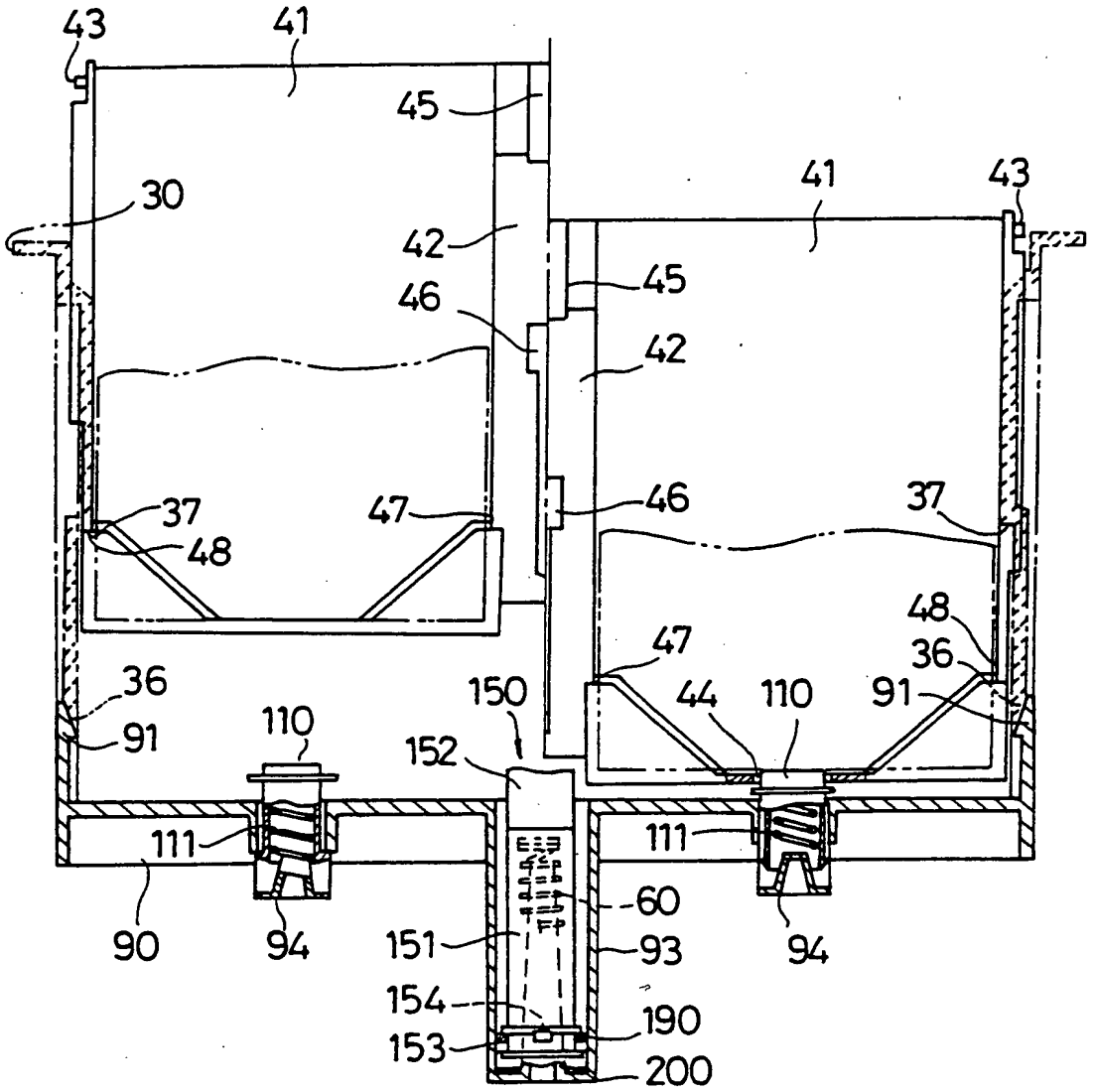
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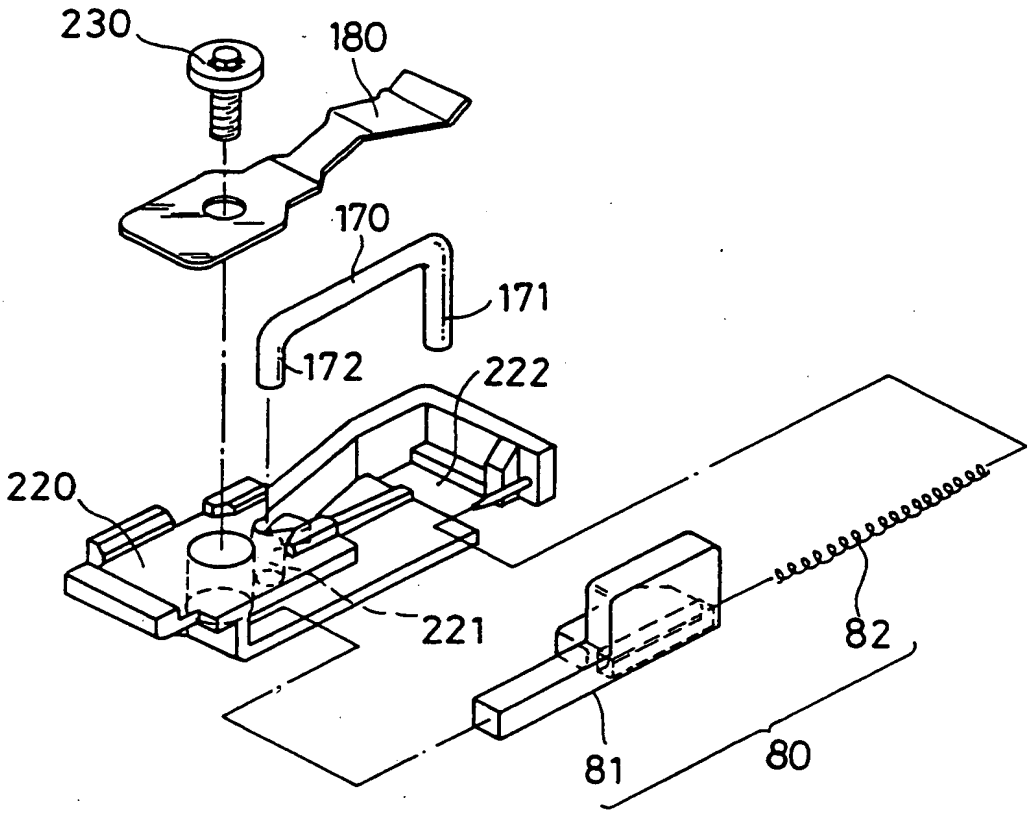

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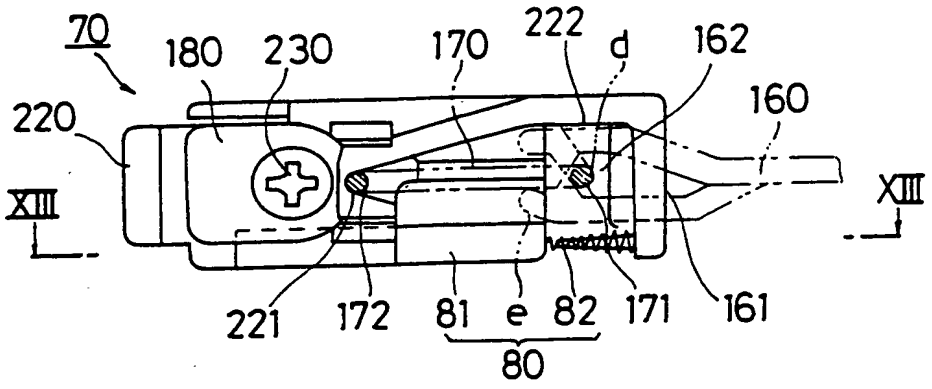

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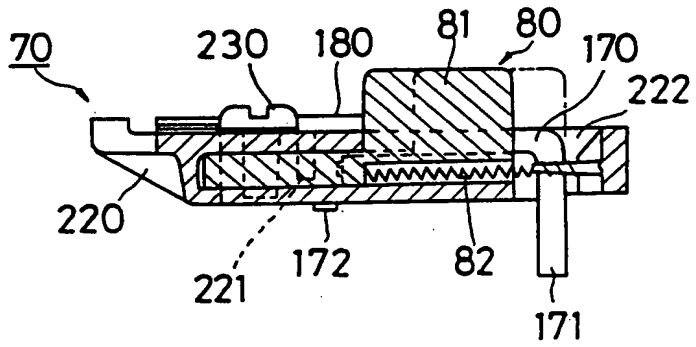

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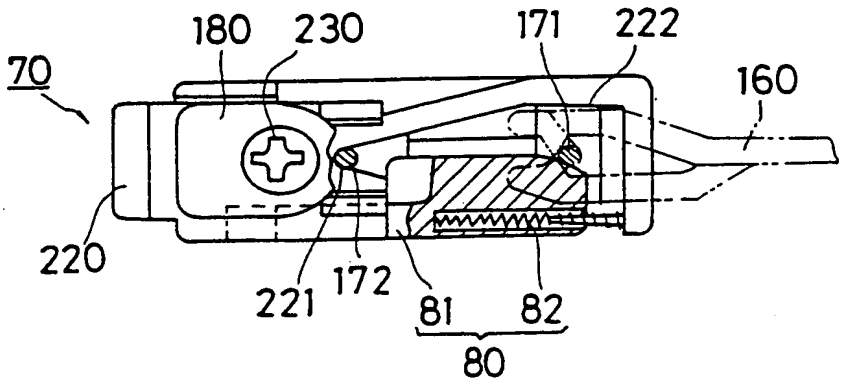

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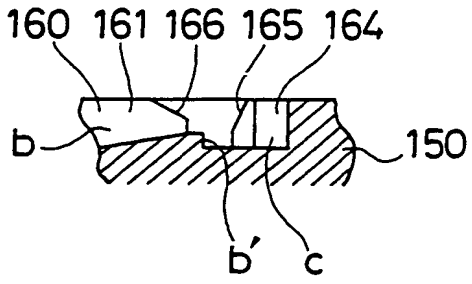

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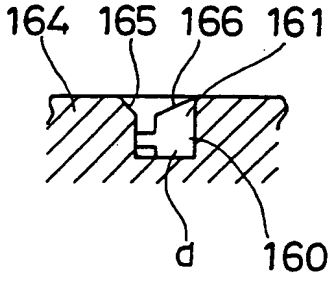

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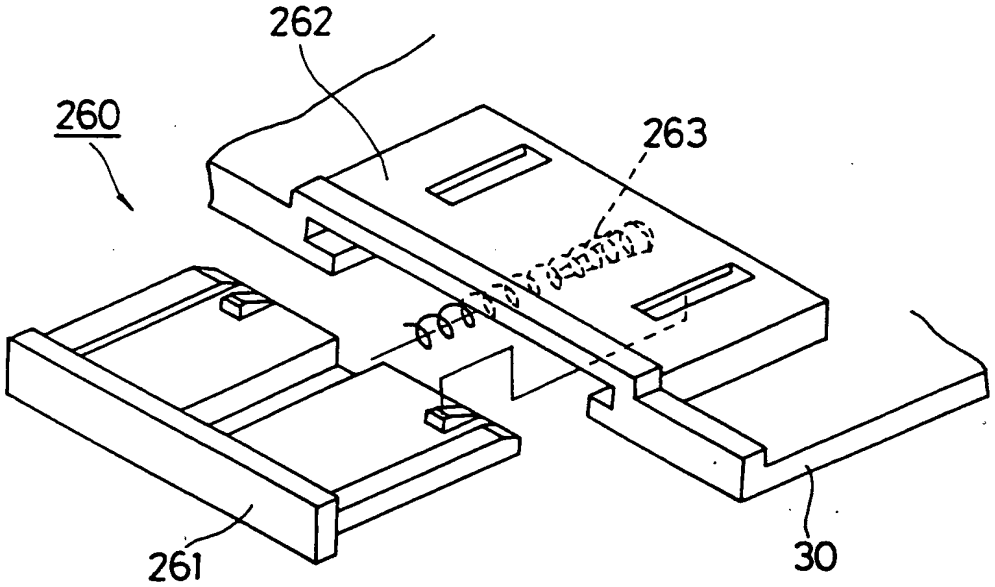

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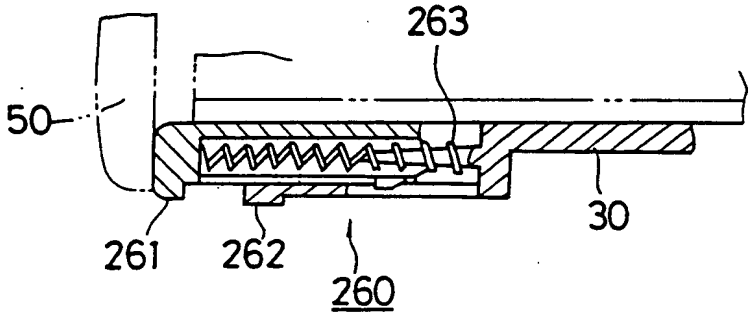

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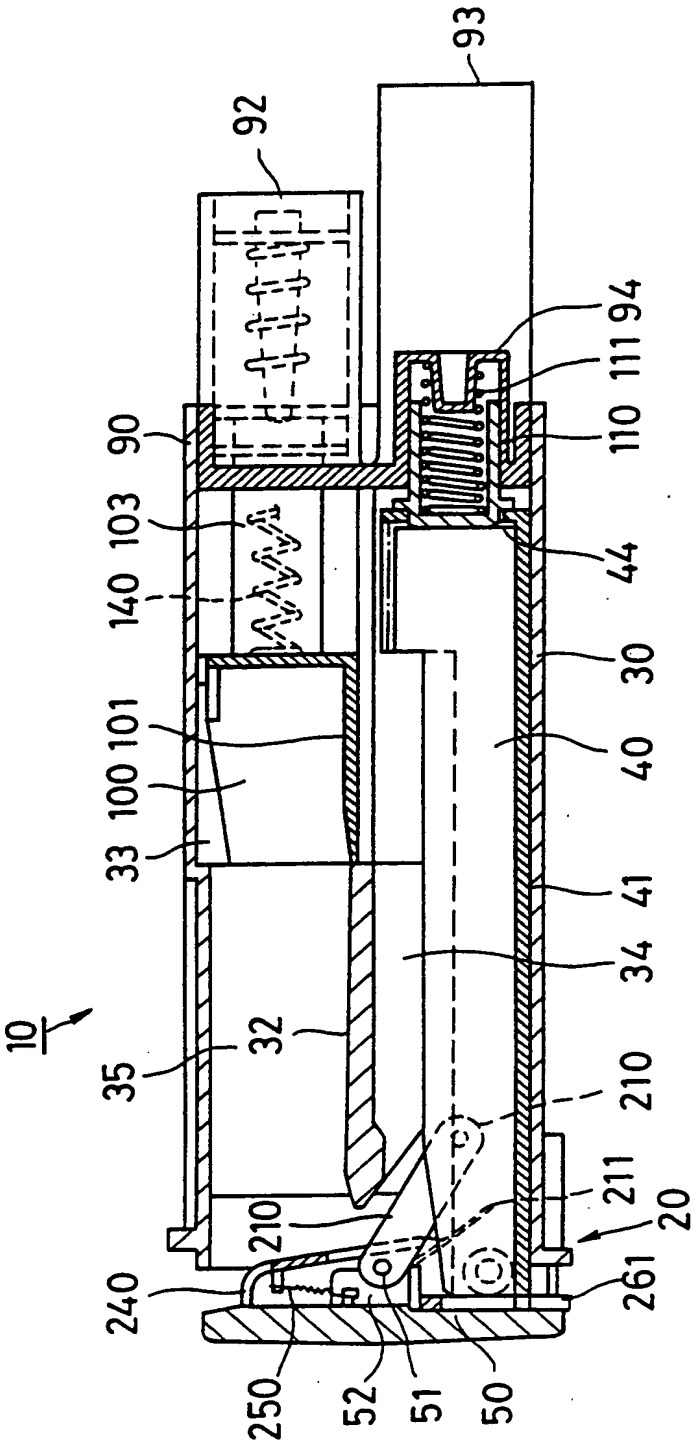
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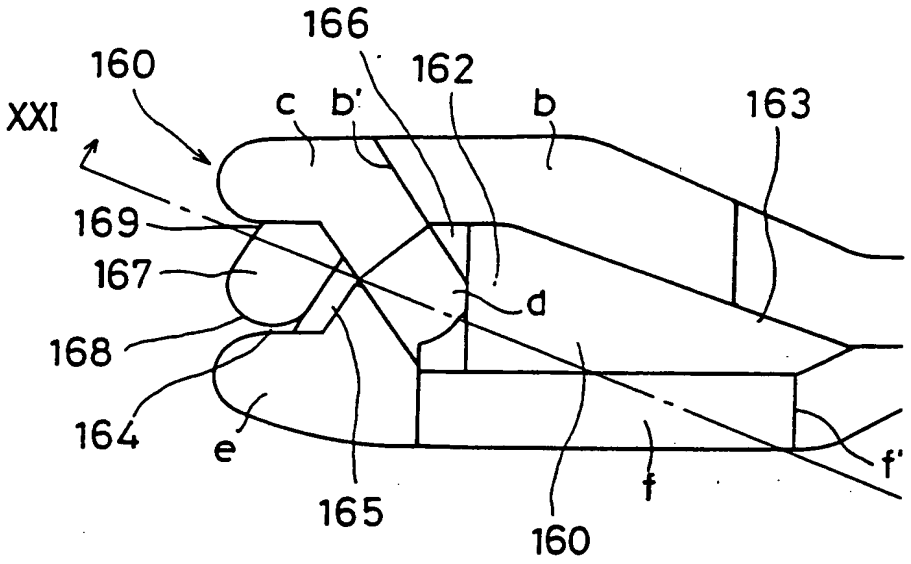
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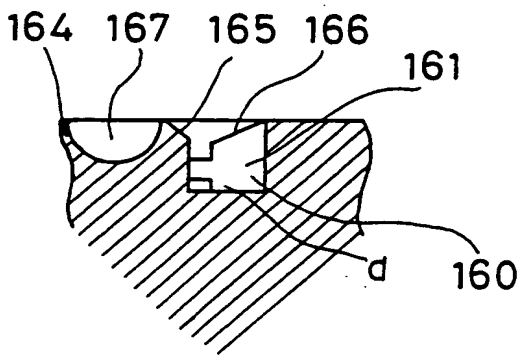
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Nifco Inc. 21/3398/01

VEHICLE-MOUNTED STORAGE APPARATUS EQUIPPED WITH A SAFETY LOCK DEVICE

This invention relates to vehicle-mounted storage apparatus equipped with a safety lock device which operates when an inertia force is applied such as during vehicle crashing.

Conventionally, as in Japanese Patent Laid-Open No. Sho 64-41434, vehicle-mounted storage apparatus comprises a housing having an opening, a projecting object held in the housing movably in the projecting direction from the opening, a forcing means for forcing the projecting object in the projecting direction from the opening in the housing, a lock device for maintaining the projecting object in a locked state at a non-projecting position against the force of the forcing means and for releasing the locked state when the projecting object in the non-projecting position is further pressed into the housing, and a safety device for stopping the unlocking operation of the lock device when an inertia force is applied, with the lock device being composed of a cam groove formed in either one of the housing or the projecting object, a lock pin pivotally supported on the other one of the housing or projecting object, and a pressing means for pressing the lock pin towards the bottom of the cam groove, and with the cam groove having a heart-shaped island at its centre and an outer peripheral wall spaced from the heart-shaped island.

In the conventional storage apparatus, however, there have been disadvantages that the lock pin would undesirably become bent, or the outer peripheral wall of the cam groove would be broken off, due to the hard collision of the lock pin with the outer peripheral wall of the cam groove when an abrupt inertia force was applied.

It is, therefore, an object of this invention to provide a vehicle-mounted storage apparatus equipped with a safety lock device, which is capable of preventing the lock pin and the outer peripheral wall of the cam groove from being damaged in such circumstances.

According to the present invention, a vehicle-mounted storage apparatus equipped with a safety lock device comprises:

a housing having an opening; a projecting object held in the housing movably in the projecting direction from the opening; a forcing means for forcing the projecting object in the projecting direction from the opening in the housing; a lock device for maintaining the projecting object in a locked state at a non-projecting position against the force of the forcing means and for releasing the locked state when the projecting object in the non-projecting position is further pressed into the housing; and a safety device for stopping the unlocking operation of the lock device when an inertia force is applied;

said lock device being composed of: a cam groove formed in either one of the housing or the projecting object and having a heart-shaped island as its centre; a lock pin pivotally supported on the other one of the housing or the projecting object for tracing the bottom of the cam groove; and a pressing means for pressing the lock pin towards the bottom of the cam groove;

said cam groove being sequentially composed of: an introductory path extending towards a sharpened tapering portion at one end of the heart-shaped island; an outward path extending along one side of the heart-shaped island with a depth becoming gradually shallower than the introductory path; a doubled portion deeper than the shallowest end of the outward path, to resist return of the lock pin to the outward path; a stopping portion deeper than the doubled portion, to resist return of the lock pin to the doubled portion, extending along a heart-shaped

constricted portion at the centre of the other end of the heart-shaped island; an escape portion deeper than the stopping portion, to resist return of the lock pin to the stopping portion; and a returning path extending along the other side of the heart-shaped island with a depth gradually becoming shallower than the escape portion, to be communicated with the introductory path at a shallowest end of the returning path higher than the bottom of the introductory path; and

said cam groove having an outer peripheral wall spaced from the heart-shaped island, with a part of the outer peripheral wall projecting towards the heart-shaped constricted portion of the heart-shaped island having a tapered surface inclined away from the bottom of the stopping portion to define a ramp for the lock pin when an inertia force is applied.

In the locked state, the projecting object would become further pressed into the housing when an inertia force is applied. As a result, a distal end of the lock pin would be disengaged from the stopping portion of the cam groove to move along the tapered surface of the projecting portion from the bottom of the stopping portion. At this time, since the tapered surface is inclined toward the bottom of the stopping portion of the cam groove, the distal end of the lock pin would get on the tapered surface so as to be popped-up against the pressing force of the pressing means. Thereafter, due to the swing-returning effect of the inertia force and the force of the forcing means, the projecting object moves toward the projecting direction from the opening of the housing. In accordance with this movement of the projecting object, the distal end of the lock pin will fall down again to the bottom of the stopping portion of the cam groove along the tapered surface, whereupon the force of the forcing means would be received by the lock pin in the stopping portion of the cam groove.

Thus, the lock device can maintain the locked state so as to prevent the projection of the projecting means into the vehicle compartment from the opening of the housing.

Preferably, said housing is in the form of a flat hollow box having opened vertical front and rear surfaces, the opened rear surface of the housing is closed by a rear cover, a partition extends in the forward/backward direction substantially at the centre of the height of the housing and divides the hollow inside of the housing substantially into upper and lower chambers, the upper chamber is formed to store an upper cassette holder slidably therein and the lower chamber is formed to store a lower cassette holder slidably therein, a concave chamber having an opened upper surface is formed at the widthwise centre of a front edge portion of an upper wall of the housing and passes through the partition from the upper chamber partly into the lower chamber, and the inside of the upper chamber is formed such that cassette cases can be stored laterally to the left and right sides of the concave chamber.

Preferably, said projecting object comprises: a cassette holder for mounting cassette cases thereon and projecting forwardly from the opening of the housing; a lid pivotally supported on the front edge portion of the cassette holder to close the opening of the housing, and falling down forwardly when projected forward with the cassette holder to open the opening in the housing; and a piston for sliding together with the cassette holder and the lid.

Preferably, said safety device includes a response-moving body, for projecting into a swinging area of a distal end of the lock pin when an inertia force is applied to prevent the distal end of the lock pin from being moved to the escape portion from the stopping portion of the cam groove, and a retracting spring for continually forcing the response-moving body towards an area out of the swinging area of the distal end of the lock pin.

Preferably, the lock pin, the pressing means and the safety device are fixed to the housing.

Preferably, a lower edge portion of the tapered surface is slightly separated from the bottom of the stopping portion of the cam groove, diagonally traversing the stopping portion from the doubled portion forwardly towards the escape portion, and an upper edge portion of the tapered surface is formed to be substantially in parallel to the lower edge portion thereof.

Preferably, a guide groove having one end opened towards the doubled portion and the other end closed is formed alongside an upper edge portion of the tapered surface in the projecting part of the outer peripheral wall of the cam groove.

The accompanying drawings show two embodiments of vehicle-mounted storage apparatus equipped with a safety lock device according to the present invention, wherein:

FIG. 1 is a plan view showing essential parts of the cam groove of one embodiment;

FIG. 2 is an exploded perspective view of the storage apparatus of said embodiment;

FIG. 3 is a perspective view showing an assembled state of the storage apparatus;

FIG. 4 is a perspective view showing a state where a lid of the apparatus is opened;

FIG. 5 is a cross-sectional view cut along the line V-V in FIG. 3;

FIG. 6 is a cross-sectional view cut along the line VI - VI in FIG. 3;

FIG. 7 is a cross-sectional view cut along the line VII - VII in FIG. 4;

FIG. 8 is a cross-sectional view cut along the line VIII - VIII in FIG. 4;

FIG. 9 is a cross-sectional view showing essential parts of an upper slide holder for explanation;

FIG. 10 is a cross-sectional view showing essential parts of a lower slide holder for explanation;

FIG. 11 is an exploded perspective view of a lock pin and a safety device;

FIG. 12 is a plan view showing the essential parts of the lock pin and the safety device in assembled state;

FIG. 13 is a cross-sectional view cut along the line XIII-XIII in FIG. 12;

FIG. 14 is a plan view of essential parts of the safety device in operating state, corresponding to FIG. 12;

FIG. 15 is a cross-sectional view cut along the line XVI - XVI in FIG. 1;

FIG. 16 is a cross-sectional view cut along the line XV-XV in FIG.1;

FIG. 17 is an exploded perspective view showing a vibration isolator;

FIG. 18 is a cross-sectional view of essential parts of the vibration isolator shown in FIG. 17 in assembled state;

FIG. 19, corresponding to FIG. 6, is a cross-sectional view showing the state of a cassette case being empty;

FIG. 20 is a plan view showing essential parts of the cam groove of another embodiment; and

FIG. 21 is a cross-sectional view showing the cam groove shown in FIG. 20 cut along the line XXI-XXI.

The present invention will be described further in detail with reference to the accompanying drawings.

In FIGS. 2 - 8, the numeral 10 designates a storage apparatus which is secured by being embedded in for example an instrument panel of a vehicle compartment such that compact cassette cases 20 can be stored in upper and lower stages.

The storage apparatus 10 comprises: a hollow box-type housing 30 having an opening 31 in front thereof; a projecting object held in the housing 30, to be movable in the projecting direction from the opening 31, in the form of a lower cassette holder 40 forwardly projectable from the opening 31 of the housing 30 with the cassette cases 20 mounted thereon; a lid 50 pivotally supported on the front

edge portion of the lower cassette holder 40 to open/close the opening 31 of the housing 30, and forwardly projectable integrally with the lower cassette holder 40 to incline forwardly down to open; a piston 150 sliding integrally with the lower cassette holder 40 and the lid 50; a forcing means for forcing the lower cassette holder 40, the lid 50 and the piston 150 in the projecting direction from the opening 31 of the housing 30, mainly a forcing spring 60 operable on the lower cassette holder 40 and the lid 50; a lock device 70 for locking the lower cassette holder 40 at a non-projecting position, in this case a storage position (see FIGS. 5 and 6) in the housing 30 against the force of the spring 60, and for unlocking the lower cassette holder 40 when the holder 40 is pressed into the housing 30 through the lid 50 at the storage position; and a safety lock device 80 (see FIGS. 12 - 14) for stopping the unlocking operation of the lock device 70 when an inertia force is applied.

As shown in FIG. 2, the housing 30 has front and rear surfaces both opened in the form of hollow box with a vertically flat configuration, and is formed by integral moulding using a plastic having a moderate rigidity. The opened rear surface of the housing 30 is closed by a rear cover 90 as shown in FIGS. 2, 5 and 6.

Within the hollow inner side of the housing 30, as shown in FIGS. 2 and 6, there is provided a partition 32 extending in the forward/backward direction almost at the centre of its height, the partition 32 dividing the hollow inner side substantially into upper and lower chambers 33, 34.

As shown in FIGS. 6 and 8, the upper chamber 33 and the lower chamber 34 of the housing 30 store slidably the upper cassette holder 100 and the lower cassette holder 40 respectively.

On the upper wall of the housing 30, as shown in FIGS. 2 - 5, a tube-type concave chamber 35, which is partly projecting toward the lower chamber 34 passing through the

partition 32 from the upper chamber 33 of the housing 30 and having an opened upper surface, is formed. This concave chamber 35 divides the opening end portion of the upper chamber into left and right parts. Therefore, the inside of the upper chamber 33 can store laterally two cassette cases 20 at the left and right sides. As described later, a part of the lock device 70 and the safety device 80 are disposed within the concave chamber 35.

As shown in FIGS. 2 - 10, the rear cover 90 is removably mounted on the rear edge portion of the housing 30, and integrally moulded using a plastic having a moderate elasticity and rigidity.

Namely, a plurality of mounting claws 91 are formed at the left, centre and right portions of the rear cover 90 as shown in FIGS. 2, 9 and 10. A plurality of mounting grooves 36 to be engaged with the mounting claws 91 are formed in the housing 30.

Accordingly, when the mounting claws 91 of the rear cover 90 are inserted from the rear side of the housing 30 by being slid along the outer surface of both side walls, they will securely be engaged with the mounting grooves 36 of the housing 30. Thus, the rear cover 90 can be mounted on the rear end portion of the housing in one touch, and the opened rear surface is covered by the rear cover 90.

At the widthwise centre of the rear cover 90, as shown in FIGS. 2 - 10, upper and lower cylinders 92, 93, which project backwardly in alignment with the upper and lower chambers 33, 34 respectively, are provided. The lower cylinder 93 is longer than the upper cylinder 92 located thereabove.

At the left and right sides of the lower cylinder 93, as shown in FIGS. 2, 6, 8 - 10, a pair of left and right button cylinders 94, 94 projecting backwardly from the rear side surface of the rear cover 90 are provided, respectively. The button cylinders 94, 94 have a smaller inner diameter and shorter entire length in comparison with those of the aforementioned cylinders 92, 93.

As shown in FIGS. 2, 6, 8 - 10, a pressing button 110 and a pressing spring 111 for forcing the pressing button 110 in the projecting direction from the open end of the button cylinders 94 are provided.

The above-mentioned pressing buttons 110 project into the lower chamber 34 of the housing 30 from the inner side of the respective button cylinders 94, due to the compressed restoring force of the pressing springs 111 as shown in FIGS. 6, 8 and 10. As shown in FIGS. 6 and 10, the pressing buttons 110 project into the lower cassette holder 40 and, as mentioned later, elastically come into contact with the rear surface of the cassette cases 20 held within the lower cassette holder 40 due to the compressed restoring force of the pressing springs 111, so as to prevent the cassette cases 20 from being rickety in the lower cassette holder 40.

The lower cassette holder 40, as shown in FIGS. 2, 4, 8 and 10, comprises: a pair of tray-type left and right cassette mounting portions 41, each capable of mounting a cassette case 20 in lay-down state thereon; and a guide frame 42 disposed substantially at the centre of the cassette mounting portions 41 and extending in the forward/backward direction in the form of a tunnel, which is integrally formed e.g. by using a plastic having a moderate elasticity and rigidity.

The cassette mounting portions 41 have a pair of left and right projecting shafts 43, 43 projecting laterally in the outward left and right directions at the front edge portion of outer surface of the left and right side walls.

At the rear wall of each cassette mounting portion 41, a circular button aperture 44 passing through in the forward/backward direction is formed for receiving the pressing button 110 to pass therethrough.

A slit 45 extending in L-letter form from the front surface to the upper surface is formed at the distal end of the guide frame 42, and along the length of the guide frame

42 there is formed a long aperture 46 extending in the forward/backward direction as shown in FIGS: 2, 5 and 10.

The upper cassette holder 100, as shown in FIGS. 2, 5-9, comprises: a pair of tray-type left and right cassette mounting portions 101, each capable of mounting the rear portion of a cassette case 20 in lay-down state thereon; a tunnel-type central frame portion 102 located substantially at the centre of the cassette mounting portions 41 and extending long and narrow in the forward/backward direction; and a piston portion 103 extending backwardly from the central frame portion 102 and slidably held in the upper cylinder 92 of the rear cover 90. This upper cassette holder 100 is integrally formed of a material such as a plastic having a moderate rigidity.

The piston portion 103, as shown in FIGS. 2, 5 - 9, has a configuration of a hollow tube, and a ring groove 104 is formed at the outer periphery thereof. At the bottom of the ring groove 104, an evacuate groove 105 being deeper than the residual part is formed at its first half portion. At the ring groove 104 of the piston portion 103, an O-ring having a diameter less than the groove width is engaged as shown in FIG. 2, 5 - 9.

As shown in FIGS. 5 and 7, an orifice 92a is formed at the rear surface of the bottom wall of the upper cylinder 92.

A filter 130 for filtering air absorbed through the orifice 92a is inserted into the upper cylinder 92 as shown in FIGS. 2, 5 - 9.

Thereafter, the pressing spring 140 is inserted into the upper cylinder 92, and this spring 140 is compressed between the bottom of the upper cylinder 92 and the hollow inner side surface of the piston portion 103.

Accordingly, the upper cassette holder 100 will be forced toward the opening 31 of the housing 30 due to the compressed restoring force of the pressing spring 140, as shown in FIGS. 8 and 9.

The most advanced position of the upper cassette holder 100, as shown in FIGS. 8 and 9, is limited by the front end surfaces of the side walls of the left and right cassette holder mounting portions 101 coming into contact with left and right engaging notches 37, 37 inwardly projecting in mutually opposed state from the inner surface of the left and right side walls of the housing 30, and by the front end surface of the bottom wall coming into contact with the rear surface of the concave chamber 35 projecting into the upper chamber 33 of the housing 30.

The lock device 70 is, as shown mainly in FIG. 2, formed on the housing 30 and the projecting object, in this case the lower cassette holder 40 and the piston 150 integrally sliding with the lid 50. The lock device is composed of a cam groove 160 with the heart-shaped island 161 as its centre, a lock pin 170 for tracing the bottom of the cam groove 160 and pivotally supported on the residual one of the housing 30 or the piston 150, in this case on the housing 30, and a pressing spring 180 as a pressing means for pressing the lock pin 170 toward the bottom of the cam groove 160.

As shown in FIG. 2, the piston 150 is composed of a piston body 151 held slidably in the lower cylinder 93 of the housing 30 and a rod portion 152 inserted into the guide frame 42 of the lower cassette holder 40. This piston 150 is integrally formed e.g. by a plastic.

The piston body 151 has the form of a hollow tube as shown in FIGS. 2, 5, 7 and 10 to be capable of receiving the forcing spring 60 thereinto. A ring groove 153 is formed at the outer peripheral portion of the piston body 151, and an evacuate groove 154 being deeper than the residual part is formed at the first half part of the bottom of the ring groove 153.

As shown in FIGS. 2, 5, 7 and 10, an O-ring 190 of a diameter smaller than the width of the ring groove 153 is engaged with this groove 153 of the piston body 151. The piston body 151 is, with the O-ring 190 being engaged

therewith, inserted into the lower cylinder 93 of the housing 30.

As shown in FIGS. 5 and 7, an orifice 93a is formed at the rear surface of the lower cylinder 93.

A filter 200 for filtering the air absorbed through the orifice 93a is inserted into the lower cylinder 93 as shown in FIGS. 2, 5, 7 and 10.

Thereafter, the forcing spring 60 is inserted into the lower cylinder 93 to be compressed between the closed surface in the hollow inside of the piston body 151 and the bottom surface of the lower cylinder 93.

At the distal end of the rod portion 152, an end portion of a joint 210 is pivotally supported as shown in FIGS. 2, 4 - 8. The other end portion of the joint 210 is projected forwardly through the slit 45 of the guide frame 42, and its projected distal end portion has the pivotally supported lid 50.

Therefore, the rod portion 152 of the piston 150 and the lid 50 are mutually coupled through the joint 210, and the lid 50 is further pivotally supported on the projecting shafts 43 of the lower cassette holder 40.

Accordingly, the lower cassette holder 40 and the lid 50 are forced toward the projecting direction from the opening 31 of the housing 30 through the piston 150 due to the compressed restoring force of the forcing spring 60, as shown in FIGS. 7 and 8.

Further, steeply-rising and forwardly directed engaging end surfaces 47, 48 are formed at both rear sides of the guide frame 42 of the lower cassette holder 40 and at the rear portion of the side wall of both cassette mounting portions 41, as shown in FIGS. 2, 6, 8 and 10.

In contrast, the backwardly directed engaging notches 37 are formed at both inner side surfaces opposed to the left and right sides respectively in the lower chamber 34 of the housing 30, as shown in FIG. 10.

Accordingly, both the engaging end surfaces 48 of the lower cassette holder 40 come to contact with both the

engaging notches 37 in the housing 30 as shown at the left-hand in FIG. 10, and both the engaging end surfaces 47 at both sides of the guide frame 42 of the lower cassette holder 40 come to contact with the rear surface of the concave chamber 35 projecting into the lower chamber 34 of the housing 30 as shown in FIG. 8, thereby the most advanced position of the lower cassette holder 40 is limited.

The most advanced position of the lower cassette holder 40 is set, in comparison with the most advanced position of the aforementioned upper cassette holder 100, such that the front surface of its rear wall is at the opening 31 side of the housing 30. The reason why the most advanced position of the lower cassette holder 40 is set at the proximal side is that with such a position the cassette cases 20 become vertically projected in staircase form, thereby the cassette cases 20 can be easily taken out.

As shown in FIGS. 1 and 2, the cam groove 160 of the piston 150 is formed in the upper surface of the rod portion 152 of the piston 150.

More specifically, as shown in FIG. 1, the cam groove 160 is formed with a heart-shaped island 161 as its centre, and a substantially U-letter constricted portion 162 of the heart-shaped island 161 and a tapering portion 163 positioned at the opposed side of the constricted portion 162 are disposed towards the forward and backward directions, respectively, of the rod portion 152 of the piston 150.

As shown in FIG. 1, the cam groove 160 comprises: an introductory path a linearly extending to the sharpened tapering portion 163 of the heart-shaped island 161 from the rear side, and having a closed rear end portion; an outward path b extending forwardly along one side of the heart-shaped island 161 with a depth becoming gradually shallower from the introductory path a; a doubled portion c being closed and having a depth deeper than the shallowest end b' of the outward path; a stopping portion

d formed after the doubled portion c along the constricted portion 162 of the heart-shaped island 161, and being deeper than the doubled portion; an escape portion e formed after the stopping portion d, extending toward the other side of the heart-shaped island 161, and being deeper than the stopping portion d and closed; and a returning path f extending along the other side of the heart-shaped island to be communicated with the introductory path a, with a depth becoming shallower gradually from the escape portion e, and having the shallowest end f' higher than the bottom of the introductory path a.

A tapered surface 165 inclined downwardly to the bottom of the stopping portion d of the cam groove 160 is formed at a projecting portion 164 projecting towards the constricted portion 162 of the heart-shaped island 161 located at the outer circumference of the cam groove 160, as shown in FIGS. 1, 15 and 16. The lower edge portion of the tapered surface 165 is separated slightly in the upward direction from the bottom of the stopping portion d of the cam groove 160, and extends in the diagonally forward direction to the escape portion e, diagonally traversing the stopping portion d from the doubled portion c. The upper edge portion of the tapered surface 165 is substantially in parallel to its lower edge portion.

As described later, the tapered surface 165 acts to protect the lock pin 170 from damage when an inertia force is applied, by engaging with the lock pin 170 so that the distal end 171 of the lock pin 170 moves along the inclined tapered surface 165 such that the lock pin 170 is popped-up against the force of a pressing spring 180.

A cut-down portion 166 downwardly inclined toward the bottom of the stopping portion d of the cam groove 160 is formed in the vicinity of the constricted portion 162 of the heart-shaped island 161 at the inner peripheral edge of the cam groove 160, as shown in FIGS. 1, 15 and 16. The lower edge of the cut-down portion 166 is slightly separated in the upward direction from the bottom of the

stopping portion d of the cam groove 160, and is inclined more tenderly in comparison with the tapered surface 165 aforementioned as shown in FIGS. 1, 15 and 16.

The cut-down portion 166 is intended to prevent interference of the lock pin 170 with the heart-shaped island 161 when the lock pin 170 moves in the cam groove 160.

In other words, since the distal end 171 of the lock pin 170 is downwardly bent in the form of L-letter as shown in FIG. 11, this bent portion may easily be interfered, in particular, with the corner portion of the heart-shaped island 161 facing the outward path b, the doubled portion c and the stopping portion d. Therefore, for preventing such interference, the cut-down portion 166 is formed at the corner portion of the heart-shaped island 161.

As shown in FIGS. 11 - 14, the lock pin 170, the pressing spring 180 and the safety device 80 are assembled to the mounting substrate 220 in unit form. This mounting substrate 220 with the lock pin 170, the pressing spring 180, and the safety device 80 being mounted thereon, is fixed to the bottom of the concave chamber 35 of the housing 30 using a fixing screw 230.

To start with, the lock pin 170 is formed by bending both ends of a metallic linear material having a circular cross section into substantially U-letter such that one end thereof is shorter than the other end.

The shorter end portion of the lock pin 170, as a shaft portion 172, is supported in a shaft aperture 221 formed in the mounting substrate 220, as shown in FIG. 13.

The longer end portion of the lock pin 170, as a distal end portion 171, projects downwardly through a window portion 222 formed in the mounting substrate 220, as shown in FIG. 13. The distal end 171 of the lock pin 170 projecting downwardly through the window portion 222 of the substrate 220 further projects into the lower chamber 34 of the housing 30 through a through hole 37 formed at the bottom of the concave chamber 35 of the housing 30. The

distal end 171 of the lock pin 170 projecting into the lower chamber 34 of the housing 30 projects further into the cam groove 160 of the piston 150 through a long hole 46 of the guide frame 42 of the lower cassette holder 40 located within the lower chamber 34 of the housing 30, as shown in FIGS. 5 and 7.

The pressing spring 180 is fixed to the mounting substrate 220 using the fixing screw 230 for fixing the mounting substrate 220 within the concave chamber 35 of the housing 30. The pressing spring 180 functions to press the lock pin 170 toward the bottom of the cam groove 160 by its spring force, and to prevent the shaft portion 172 of the lock pin 170 from falling out upwardly from the shaft aperture 221 of the mounting substrate 220.

The safety device 80 is composed of a response-moving body 81 which projects into the swinging area of the distal end 171 of the lock pin 170 when the inertia force is applied, such that the distal end 171 of the lock pin 170 can be prevented from moving to the escape portion e from the stopping portion d of the cam groove 160, and a retracting spring 82 which always forces the response-moving body 81 toward the area out of the swinging area of the distal end 171 of the lock pin 170, as shown in FIG. 11.

The response-moving body 81 is made of metallic material, and mounted slidably on the mounting substrate 220 as shown in FIGS. 12 - 14.

The retracting spring 82 is compressed between the mounting substrate 220 and the response-moving body 81 as shown in FIGS. 12 and 13, and its compressed restoring force acts to force the response-moving object 81 toward the area out of the swinging area of the lock pin 170.

The inertia force required to operate the response-moving body 81 can be freely set by varying the spring constant of the retracting spring 82 when the material and form thereof are fixed. In the shown embodiment, the

inertia force for operating the response-moving body 81 is set to a value of 3 - 10G, for example.

Therefore, only when an abrupt inertia force exceeding 3G, occurring upon crashing of a motorcar, is applied, does the response-moving body 81 come to project into the swinging area of the lock pin 170 against the compressed restoring force of the retracting spring 82 (FIG. 14).

A viscous fluid such as a grease is coated on the sliding contact surface of the response-moving body 81 with the mounting substrate 220 such that the response-moving body 81 having projected into the swinging area of the lock pin 170 does not abruptly return.

In contrast, at a light inertia force of less than 3G, occurring at the abrupt starting or braking of a vehicle, the response-moving body 81 maintains the state of being out of the swinging area of the lock pin 170, due to the compressed restoring force of the retracting spring 82 (FIG. 12, 13).

Next, as to the structure of the lid 50, this lid 50 has plate form and is integrally formed of e.g. a plastic having a moderate elasticity and rigidity.

A pair of coupling pieces 52, 52, protruding opposedly from the inner side surface directed upwardly, and having a shaft portion 51 for pivotally supporting the joint 210, are formed substantially at the centre of the lid 50.

A pair of left and right guide ribs 53, 53, acting as guides when the cassette case 20 is inserted into the lower cassette holder 40 and protruding substantially in the form of a triangle from the inner side surface upwardly directed, are formed at the left and right end portions of the lid 50. Shaft apertures 54, 54 to be engaged by the pair of left and right projecting shafts 43 projecting outwardly from the lower cassette holder 40 are formed at the rear end portions of the guide ribs.

In the space between the coupling pieces 52 of the lid 50, the other end of the joint 210 is inserted making use of the elasticity of the coupling pieces 52 such that the

joint 210 is pivotally supported on the shaft portion 51 of the coupling pieces 52.

Accordingly, the lid 50 and the piston 150 are mutually coupled through the joint 210.

The projecting shafts 43 of the lower cassette holder 40 are inserted into the shaft apertures 54 of the lid 50 making use of the elasticity of the left and right side walls of the lower cassette holder 40 or the guide rib 52 of the lid 50.

As a result, the lid 50 will rotate with the projecting shafts 43 of the lower cassette holder 40 as its centre, and incline forwardly in front of the opening 31 of the housing 30 to open as shown in FIGS. 4, 7 and 8. The maximum open angle of the lid 50 is limited by the contact of the upwardly directed rear end portion of the inner side surface with the lower surface of the bottom wall of the lower cassette holder 40, as shown in FIGS. 7, 8. At this time, the upwardly directed inner surface of the lid 50 is set to be substantially flush with the upper surface of the bottom wall of the lower cassette holder 40.

The joint 210 has a plate spring portion 211 extending diagonally and backwardly from its lower surface as shown in FIGS. 2, 5 and 7, and is integrally formed of e.g. a plastic having a moderate elasticity and rigidity. This plate spring portion 211 acts to prevent abrupt opening of the lid 50 by contacting elastically with the upwardly directed inner surface of the lid 50 when the lid is opened.

Further, the upper side of the joint 210 is covered with a hollow cup-type case 240, as shown in FIGS. 2, 4 - 8. A tensile spring 250 is engaged between the hollow inner surface of the case 240 and the lid 50 as shown in FIGS. 2, 5 and 6, and the restoring force of this tensile spring 250 acts to maintain the state of the case 240 against the lid 50. The case 240, cooperating with the guide rib 52 of the lid 50, functions as a guide when the cassette case 20 is inserted into the lower cassette case holder 40.

On the other hand, the numeral 260 in FIGS. 2, 17 and 18 designates a vibration isolator of the lid 50. The vibration isolator 260 comprises: a pressure body 261 to be in contact with the inner surface of the closed lid 50; a guide frame 262 for holding slidably the pressure body 261; and a vibration-isolating spring 263 for forcing the pressure body 261 toward the direction projecting from the guide frame 262.

Therefore, the pressure body 261, as shown in FIG. 18, comes to be in elastic contact with the inner surface of the closed lid 50 such that the inner surface of the lid 50 is prevented from directly crushing with the front edge portion of the opening 31 of the housing 30.

Meanwhile, the assembled storage apparatus 10 is, though not shown, embeddedly fixed together with the cassette deck and other audio apparatus to the instrument panel etc. in the vehicle compartment.

Next, the operation of the storage apparatus 10 will be described.

The lid 50 in its closed state can be easily opened by pressing its front surface towards the housing 30. Namely, when the lid 50 is pressed, the lower cassette holder 40 will retract together with the lid 50. Further, the piston 150 will retract together with the lower cassette holder 40, since the piston 150 is coupled to the lid 50 through the joint 210.

When the piston 150 is retracted, the position of the cam groove 160 at the upper surface of the piston body 151 will be varied. Therefore, the distal end 171 of the lock pin 170 having been at the stopping portion d of the cam groove 160 advances to the escape portion e being deeper than the stopping portion d in accordance with the displacement of the cam groove 160. At this time, since the doubled portion c is shallower than the stopping portion d, the distal end 171 of the lock pin 170 cannot advance to the doubled portion c from the stopping portion d. When the distal end 171 of the lock pin 170, in the escape

portion e, collides with the closed end of the escape portion e, the lid 50 is not pressed anymore.

As a result, on releasing the force for pressing the lid 50, the piston 150 advances due to the compressed restoring force of the forcing spring 60.

In accordance with the advance of the piston 150, the position of the cam groove 160 at the upper surface of the piston body 151 will be varied. In consequence, the distal end 171 of the lock pin 170 having been in the escape portion e, will leave the escape portion e to reach the returning path f. At this time, since the stopping portion d is shallower than the escape portion e, the distal end 171 of the lock pin 170 having reached the escape portion e cannot return to the stopping portion d from the escape portion e.

The distal end 171 of the lock pin 170 having reached the returning path f will further advance, due to the further moving of the piston 150, to the introductory path a which is deeper than the returning path f.

In accordance with the advancement of the piston 150, the lid 50, the lower cassette holder 40, and the cassette case 20 disposed in the lower cassette holder 40 integrally advance through the joint 210, as shown in FIGS. 4, 8.

When the piston body 151 of the piston 150 advances within the lower cylinder 93 of the rear cover 90, air is absorbed through the orifice 93a, as shown in FIG 7.

As a result, the lid 50, the lower cassette holder 40, and the cassette case 20 disposed in the lower cassette holder 40, through the joint 210, will project from the opening 31 of the housing 30 quietly and slowly.

Further, on opening of the lid 50, the plate spring portion 211 of the joint 210 elastically contacts with the upwardly directed upper surface of the lid 50 for preventing abrupt and rough opening of the lid 50, as shown in FIG. 7.

When the lid 50 advances and opens, the upper cassette holder 100 also advances toward the opening 31 of the

housing 30 due to the compressed restoring force of the pressing spring 140 , as shown in FIG. 7 and 8.

Namely, when the cassette case 20 is disposed in the upper cassette holder 100 and the lid 50 is closed, the front surface of the cassette case 20 is pressed by the inner surface of the lid 50 as shown in FIGS. 5, 6. Therefore, the upper cassette holder 100 is at the retracted position by being pressed through the cassette case 20.

On the contrary, when the lid 50 advances and opens, the front surface of the cassette case 20 is opened such that the upper cassette holder 100 will advance due to the compressed restoring force of the pressing spring 140 as shown in FIGS. 7, 8.

At this time, the piston portion 103 of the upper cassette holder 100 advances in the upper cylinder 92 of the rear cover 90 as shown in FIG. 7, thereby air is absorbed through the orifice 92a.

As a result, the cassette case 20 held on the upper cassette holder 100 will project quietly and slowly from the opening 31 of the housing 30.

As mentioned earlier, at this time, since the most advanced position of the lower cassette holder 40 is set at a more proximal side than that of the upper cassette holder 100, cassette cases 20 held in the holders 40, 100 will project vertically in staircase form from the opening of the housing 30, as shown in FIGS. 4, 8.

Next, for storing the cassette case 20 in the housing 30, firstly the lid 50 is upwardly closed, and then the lower cassette holder 40 and the cassette case 20 together with the lid 50 are pressed into the housing 30.

Upon pressing the closed lid 50 towards the housing 30, the piston 150 will be retracted through the joint 210.

When the piston 150 retracts, the position of the cam groove 160 at the upper surface of the piston body 151 will change. Therefore, the distal end 171 of the lock pin 170 having been in the introductory path a of the cam groove

160 will reversely advance along the introductory path a in accordance with the displacement of the cam groove 160, passing from the introductory path a to the outward path b. Since the shallowest end f' of the returning path f is shallower than the introductory path a, the distal end 171 of the lock pin 170 having reached the introductory path a cannot return to the returning path f from the introductory path a.

When the piston 150 further retracts, the distal end 171 of the lock pin 170 having reached the outward path b will advance to the doubled portion c which is deeper than the outward path b. The distal end 171 of the lock pin 170 having reached the doubled portion c will collide with the closed end portion of the doubled portion c, so as not to be able to press the lid any more.

Therefore, when the force for pressing the lid 50 is released, the piston 150 advances due to the compressed restoring force of the forcing spring 60.

In accordance with the advancement of the piston 150, the distal end 171 of the lock pin 170 will reversely advance from the doubled portion c to the stopping portion d which is deeper than the doubled portion c. Since the shallowest end b' of the outward path b is shallower than the doubled portion c, the distal end 171 of the lock pin 170 having reached the doubled portion c cannot return to the outward path b from the doubled portion c.

On reaching the stopping portion d, the distal end 171 of the lock pin 170 will interfere with the constricted portion 162 of the heart-shaped island 161 as shown in FIGS. 12, 13, such that the lock device 70 will be locked again by receiving the compressed restoring force of the forcing spring 60 by the constricted portion 162 of the heart-shaped island 161.

At this locked position, the opening 31 of the housing 30 will be covered with the lid 50 as shown in FIGS. 3, 5 and 6.

In accordance with the retraction of the piston 150,

the piston body 151 will retract within the lower cylinder 93 of the rear cover 90 as shown in FIG. 5.

At this time, the O-ring 190 having been engaged with the ring groove 153 of the piston body 151 will move to the first part of the ring groove 153 due to the friction resistivity with the inner periphery surface of the lower cylinder 93, as shown in FIG. 5. When the O-ring 190 moves to the first half portion of the ring groove 153, the air in the lower cylinder 93 will instantaneously be evacuated from the evacuate groove formed at the first half portion of the ring groove 153.

As a result, since there is no braking force when the lower cassette holder 40 is pressed through the lid 50, the lid 50 can be pressed with a relatively small force.

When the lower cassette case holder 40 is pressed, the pressure buttons 110 will be inserted into the button holes 44 of the rear wall as shown in FIG. 6. Both the pressure buttons 110 projecting into the lower cassette holder 40 will elastically contact with the rear surface of the cassette cases 20 being held by the lower cassette holder 40 due to the compressed restoring force of the pressure springs 111.

Accordingly, since the front surface of each cassette case 20 is elastically pressed to the inner surface of the closed lid 50, it is possible to prevent the cassette case 20 from being rickety in the lower cassette holder 40 due to the inertia force generated by travelling vibration, abrupt acceleration or deceleration of the vehicle.

On the other hand, when the lid 50 is pressed in its closed state, the front surface of the cassette case 20 held in the upper cassette holder 100 will retract by being pressed by the inner surface of the lid 50 as shown in FIGS. 5, 6.

In accordance with the retraction of the upper cassette holder 100, its piston portion 103 will retract within the upper cylinder 92 of the rear cover 90 against the compressed restoring force of the pressing spring 140.

At this time, the O-ring 120 being engaged with the ring groove 104 of the piston 103 will move to the first half portion of the ring groove 104 due to the friction resistivity with the inner periphery surface of the upper cylinder 92. When the O-ring 120 moves to the first half portion in the ring groove 104, the air in the upper cylinder 92 will instantaneously be evacuated through the evacuate groove 105 formed in the first half portion.

Therefore, no braking force will arise when the upper cassette holder 100 is pressed through the cassette case 20 such that the lid 50 can be pressed with a relatively small force.

Further, since the upper cassette holder 100 is forced toward the opening 31 of the housing 30 due to the compressed restoring force of the pressing spring 140, the rear surface of the cassette case 20 will become pressed toward the front surface of the rear wall of the upper cassette holder 100 to elastically contact with the inner surface of the closed lid 50.

Accordingly, since the front surface of the cassette case 20 is elastically pressed to the inner surface of the closed lid 50, it is possible to prevent the cassette case 20 from being rickety in the upper chamber 33 of the housing 30 due to the inertia force generated by the travelling vibration, abrupt acceleration or deceleration.

In the closed state of the lid 50, the pressure body 261 will elastically contact with the inner surface of the lid 50 due to the compressed restoring force of the vibration isolating spring 263.

Thus, it is possible to prevent the inner surface of the lid 50 from directly crushing with the front edge portion of the opening 31 of the housing 30 to become rickety, caused by the retraction of the lid 50 together with the lower cassette holder 40 by the inertia force generated by the travelling vibration, abrupt acceleration or deceleration.

On the other hand, in the state where no cassette case 20 is inserted into the holders 40, 100, the upper cassette holder 100 maintains its most advanced position and the pressure buttons 110 project into the lower cassette holder 40 to the maximum.

Next, in the locked state of the lock device 70, when an abrupt inertia force such as one exceeding 3G occurs at the vehicle crash, the safety device 80 acts to stop the unlocking operation of the lock device 70.

Namely, such an abrupt inertia force acts to make the lid 50 and the lower cassette holder 40 be retracted, thereby the lid 50 becomes pressed toward the housing 30. Therefore, the piston 150 retracts integrally with the lid 50 so as to displace the cam groove 160 formed at the upper surface of the piston 150. Then, the distal end 171 of the lock pin 170 having been in the stopping portion d of the cam groove 160 will tend to advance to the escape portion e from the stopping portion d in accordance with the displacement of the cam groove 160. At this time, the response-moving body 81 retracts against the compressed restoring force of the retracted spring 82 as shown in FIG. 14 so as to project into the swinging area of the lock pin 170. The distal end 171 of the lock pin 170 therefore contacts with the response-moving body 81 projecting into the swinging area to stop the swinging operation so as not to advance to the escape portion e from the stopping portion d anymore. Thus, the locked state of the lock device 70 can be maintained, preventing the lid 50 and the lower cassette holder 40 from being projected and the lid 50 from being opened. In consequence, on crashing of the vehicle, the lid 50 and the lower cassette holder 40 do not project into the vehicle compartment. This prevents an occupant from receiving a hard blow to the head by the projected portion such as the lid 50, thereby enhancing safety.

Next, the function of the tapered surface 165 of the cam groove 160 will be described.

When an abrupt inertia force as mentioned above is applied, the piston 150 retracts and the position of the cam groove 160 formed on the upper surface thereof will be displaced.

As a result, the distal end 171 of the lock pin 170 at the stopping portion d will move from its state in contact with the constricted portion 162 of the heart-shaped island 161 to the projecting edge portion 164 located at the opposed side thereof, in accordance with the displacement of the cam groove 160.

At this time, the distal end 171 of the lock pin 170 will engage with the tapered surface 165 formed at the projecting edge portion 164 to move along the inclined surface thereof, such that the distal end 171 of the lock pin 170 will be popped-up from the bottom of the stopping portion d against the spring force of the pressing spring 180.

As a result, the lock pin 170 can be prevented from being damaged.

Namely, if the side wall surface of the projecting edge portion 164 was a vertical wall, the distal end 171 of the lock pin 170 would be undesirably bent upon strongly crushing against the vertical wall. Once the distal end 171 of the lock pin 170 is thus bent, it cannot smoothly trace the cam groove 160.

There have been, therefore, disadvantages that the lock device 70 cannot be unlocked even after the inertia force is stopped, and the cassette case 20 cannot be taken out, or the lid 50 cannot be closed after being opened, or the lid 50 and the lower cassette holder 40 cannot smoothly slide or open/close.

In this invention, the lock pin 170 is prevented from being damaged by popping-up the distal end 171 of the lock pin 170 from the bottom of the stopping portion d against the spring force of the pressing spring 180 by virtue of the tapered surface 165 of the projecting edge portion 164.

Thereafter, when the swing back of the inertia force and the inertia force stop, the piston 150 is slightly pressed back by the compressed restoring force of the forcing spring 60. As a result, the distal end 171 of the lock pin 170, being pressed downwardly by the force of the pressing spring 180, moves along the tapered surface 165 of the projecting edge portion 164 toward the bottom of the stopping portion d. The distal end 171 of the lock pin 170 then will be interfered again with the constricted portion 162 of the heart-shaped island 161 as shown in FIGS. 12, 13, and this constricted portion 162 receives the compressed restoring force of the forcing spring 60, thereby maintaining the locked state of the lock device 70.

FIGS. 20 and 21 show another embodiment of the present invention.

This embodiment features an improved cam groove 160 for the piston 150. In particular, it is characterized in that a guide groove 167 is formed along the upper edge portion of the tapered surface 165 of the projecting edge portion 164, having one end opened toward the doubled portion c and the other end closed.

Namely, the guide groove 167 is inclined forwardly along the upper edge portion of the tapered surface 165 and is concave in the form of U-letter cross-section. The distal end 168 of the guide groove 167 is closed while the other inclined rear end 169 is opened diagonally backwardly toward the doubled portion c as shown in FIG. 20.

According to this embodiment, when an abrupt inertia force generated at the crashing of a vehicle etc. is applied, the distal end 171 of the lock pin 170 will pass over the upper edge portion of the tapered surface 165 after moving along the inclination of the tapered surface 165, and then falls down into the guide groove 167.

After stopping the swing-back of the inertia force and the inertia force, the piston 150 will be slightly pressed back by the compressed restoring force of the forcing spring 60. As a result, the lock pin 170 moves along the

guide groove 167 whilst being pressed downwardly by the spring force of the pressing force 180, and thereafter falls down into the bottom of the doubled portion c.

Further, the advancement of the piston 150 will lead the distal end 171 of the lock pin 170 to move toward the stopping portion d from the doubLed portion c so as to interfere with the constricted portion 162 of the heart-shaped island 161. This constricted portion 162 of the heart-shaped island 161 receives the compressed restoring force of the forcing spring 60 so as to lock again the lock device 70.

Since the guide groove 167 is forwardly inclined and has the inclined distal end 168 being closed, when the piston 150 retracts due to the inertia force, the distal end 171 of the lock pin 171 moves toward the closed distal end 168 of the guide groove 167 and stops at this end 168 so as not to be disengaged from the guide groove 167.

According to this embodiment, it is possible to securely lead the distal end 171 of the lock pin 170 to the stopping portion d of the cam groove 160 even when the distal end 171 of the lock pin 170 has passed over the tapered surface 165, to provide a reliable lock device 70.

For the explanation of this embodiment, the same or similar components as or to the previous embodiment referred to by the same numerals and symbols, and detailed description for such components are omitted.

In the shown previous embodiment, the lower cassette holder 40 and the lid 50 have been mentioned as projecting objects, but the lid 50 for example can be omitted.

Further, as a storage apparatus 10, it is possible to store articles other than cassette cases 20, e.g. an ashtray, glove box, coin case, and cup holder, in which case the lid, inner case, tray, cup holder, etc. will be the projecting object.

In addition, as a forcing means, any member other than the forcing spring shown in the embodiments, such as a constant-pressure spring or a tensile spring can be used.

On the other hand, though in the shown embodiments the cam groove 160 of the lock device 70 has been formed in the piston 150 of the projecting object and the lock pin 170 has been pivotally supported at the housing 30 side, it is also possible, in vice versa, to form the cam groove 160 at the housing 30 side and to pivotally support the lock pin 170 at the projecting object side.

CLAIMS

1. A vehicle-mounted storage apparatus equipped with a safety lock device comprising:

a housing having an opening; a projecting object held in the housing movably in the projecting direction from the opening; a forcing means for forcing the projecting object in the projecting direction from the opening in the housing; a lock device for maintaining the projecting object in a locked state at a non-projecting position against the force of the forcing means and for releasing the locked state when the projecting object in the non-projecting position is further pressed into the housing; and a safety device for stopping the unlocking operation of the lock device when an inertia force is applied;

said lock device being composed of: a cam groove formed in either one of the housing or the projecting object and having a heart-shaped island as its centre; a lock pin pivotally supported on the other one of the housing or the projecting object for tracing the bottom of the cam groove; and a pressing means for pressing the lock pin towards the bottom of the cam groove;

said cam groove being sequentially composed of: an introductory path extending towards a sharpened tapering portion at one end of the heart-shaped island; an outward path extending along one side of the heart-shaped island with a depth becoming gradually shallower than the introductory path; a doubled portion deeper than the shallowest end of the outward path, to resist return of the lock pin to the outward path; a stopping portion deeper than the doubled portion, to resist return of the lock pin to the doubled portion, extending along a heart-shaped constricted portion at the centre of the other end of the heart-shaped island; an escape portion deeper than the stopping portion, to resist return of the lock pin to the stopping portion; and a returning path extending along the other side of the heart-shaped island with a depth

gradually becoming shallower than the escape portion, to be communicated with the introductory path at a shallowest end of the returning path higher than the bottom of the introductory path; and

said cam groove having an outer peripheral wall spaced from the heart-shaped island, with a part of the outer peripheral wall projecting towards the heart-shaped constricted portion of the heart-shaped island having a tapered surface inclined away from the bottom of the stopping portion to define a ramp for the lock pin when an inertia force is applied.

2. An apparatus according to claim 1, wherein said housing is in the form of a flat hollow box having opened vertical front and rear surfaces, the opened rear surface of the housing is closed by a rear cover, a partition extends in the forward/backward direction substantially at the centre of the height of the housing and divides the hollow inside of the housing substantially into upper and lower chambers, the upper chamber is formed to store an upper cassette holder slidably therein and the lower chamber is formed to store a lower cassette holder slidably therein, a concave chamber having an opened upper surface is formed at the widthwise centre of a front edge portion of an upper wall of the housing and passes through the partition from the upper chamber partly into the lower chamber, and the inside of the upper chamber is formed such that cassette cases can be stored laterally to the left and right sides of the concave chamber.

3. An apparatus according to claim 2, wherein an upper cylinder and a lower cylinder, projecting backwardly in correspondence to the upper chamber and the lower chamber respectively, are disposed at the widthwise centre of the rear cover.

4. An apparatus according to claim 3, wherein the lower cylinder is longer than the upper cylinder located thereabove.

5. An apparatus according to claim 3, wherein a left button cylinder and a right button cylinder are disposed at the left and right sides of the lower cylinder, respectively, each having an inner diameter smaller than and a length shorter than the upper and lower cylinders, and each extending backwardly from the rear cover.

6. An apparatus according to claim 5, wherein each of the button cylinders has an opened end, and receives a pressure button and a pressure spring for forcing the pressure button in the projecting direction from the opened end, both of the pressure buttons being designed to project into the lower cassette holder disposed in the lower chamber of the housing from the button cylinders so as to elastically contact with a rear surface of a cassette case held in the lower cassette holder.

7. An apparatus according to claim 3, wherein said upper cassette holder includes a pair of tray-type left and right cassette mounting portions each capable of mounting a rear portion of a cassette case in laterally lay-down state, a tunnel-type central frame portion disposed between the cassette mounting portions and extending in the forward/backward direction, and a piston portion extending backwardly from the central frame portion and being held in the upper cylinder of the rear cover.

8. An apparatus according to claim 7, wherein said piston portion is formed as a hollow tube, with a ring groove being located at an outer periphery thereof, an evacuate groove at the bottom of the ring groove being deeper than the remainder of the ring groove, and an 0-ring having a diameter smaller than the width of the ring groove being engaged with the ring groove.

9. An apparatus according to claim 3, wherein an orifice is formed in a rear wall of the upper cylinder, and a filter for filtering air absorbed through the orifice is disposed against an inner side of the rear wall.

10. An apparatus according to claim 8, wherein a pressing spring is inserted into the upper cylinder and is

compressed between a rear wall of the upper cylinder and an inner surface of the hollow piston portion so that said upper cassette holder is forced towards the opening of the housing by the compressed restoring force of the pressing spring.

11. An apparatus according to claim 1, wherein said projecting object comprises: a cassette holder for mounting cassette cases thereon and projecting forwardly from the opening of the housing; a lid pivotally supported on the front edge portion of the cassette holder to close the opening of the housing, and falling down forwardly when projected forward with the cassette holder to open the opening in the housing; and a piston for sliding together with the cassette holder and the lid.

12. An apparatus according to claim 3 and claim 11, wherein said piston includes a piston body slidably held in the lower cylinder of the housing, and a rod portion extending from the piston body and inserted into a guide frame of the lower cassette holder.

13. An apparatus according to claim 12, wherein the piston body is formed as a hollow tube, a forcing spring is disposed in the piston body, a ring groove is located at an outer periphery of the rear end of the piston body, an evacuate groove deeper than the remainder of the ring groove is formed at a first half portion of the bottom of the ring groove, an O-ring having a diameter smaller than the width of the ring groove is engaged with the ring groove, and an end of a joint whose other end is pivotally supported on the lid is pivotally supported on an end of the rod portion of the piston.

14. An apparatus according to claim 13, wherein an orifice is formed in a rear wall of the lower cylinder, a filter for filtering air absorbed through the orifice is disposed against the inner side of the rear wall, a forcing spring is inserted into the lower cylinder, and the forcing spring is compressed between a closed portion of the hollow inside of the piston body and the rear wall of the lower cylinder.

15. An apparatus according to claim 1, wherein said safety device includes a response-moving body, for projecting into a swinging area of a distal end of the lock pin when an inertia force is applied to prevent the distal end of the lock pin from being moved to the escape portion from the stopping portion of the cam groove, and a retracting spring for continually forcing the response-moving body towards an area out of the swinging area of the distal end of the lock pin.

16. An apparatus according to claim 15, wherein the response-moving body is mounted slidably on a mounting substrate, and the retracting spring is compressed between the mounting substrate and the response-moving body.

17. An apparatus according to claim 1, wherein the lock pin, the pressing means and the safety device are fixed to the housing.

18. An apparatus according to claim 1, wherein the lock pin is of substantially U-shape, and is formed from a length of metallic material of circular cross-section, having one shorter end pivotally supported in a shaft hole formed in a mounting substrate and the other longer end as a distal end passing through a through hole formed at the bottom of a concave chamber in the housing to project into a lower chamber of the housing, and then pass through a long aperture of a guide frame of a cassette holder located in a chamber of the housing to be disposed in a cam groove of a piston.

19. An apparatus according to claim 1, wherein a cut-out surface is formed on the heart-shaped island, the cut-out surface being inclined downwardly towards the bottom of the stopping portion of the cam groove in the vicinity of the constricted portion of the heart-shaped island at an inner peripheral wall of the cam groove, a lower end portion of the cut-out surface being slightly separated from the bottom of the stopping portion of the cam groove and being tapered less sharply than the tapered surface.

20. An apparatus according to any preceding claim, wherein a lower edge portion of the tapered surface is slightly separated from the bottom of the stopping portion of the cam groove, diagonally traversing the stopping portion from the doubled portion forwardly towards the escape portion, and an upper edge portion of the tapered surface is formed to be substantially in parallel to the lower edge portion thereof.

21. An apparatus according to any preceding claim, wherein a guide groove having one end opened towards the doubled portion and the other end closed is formed alongside an upper edge portion of the tapered surface in the projecting part of the outer peripheral wall of the cam groove.

22. A vehicle-mounted storage apparatus equipped with a safety lock device, and substantially as hereinbefore described with reference to Figures 1 to 19, or Figures 1 to 19 as modified by Figures 20 and 21, of the accompanying drawings.